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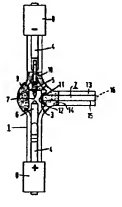
(54) **Irradiation device.**

(57) The irradiation device comprises a short arc discharge lamp (1), in whose lamp vessel (3) electrodes (5,6) are arranged, between which a discharge path (7) extends. An optical conductor (2) is sealed with its first end (11) into the wall of the lamp vessel (3) in such a manner that its light entrance window (12) is arranged laterally of the discharge path (7) and is directed to the discharge path (7).



EP 0 219 915 A1

"Irradiation device"

The invention relates to an irradiation device comprising

-a high pressure discharge lamp provided with a translucent lamp vessel, which is sealed in a vacuum-tight manner and through the wall of which current supply conductors extend to a pair of electrodes which are arranged within the lamp vessel and between which a discharge path extends, said lamp vessel being filled with an ionizable gas, and

-at least one optical conductor provided with a light entrance window at a first end, said optical conductor being arranged laterally of the discharge path in such a manner that the light entrance window is directed to the discharge path.

Such a device is known from U.S. Patent Specification 4,009,382 (Günter Nath, 22.2.1977).

In the known device, the optical conductor and the high-pressure discharge lamp are detachably connected to each other. Although the optical conductor has a comparatively large light entrance window, the discharge path of the discharge lamp has considerably larger dimensions so that, also due to the fact that the numerical aperture of optical conductors is small, only a small part of the generated radiation is collected by the optical conductor.

The DE-GM 8,313,972 (Helmut Hund KG, 3.11.1983) discloses a device in which due to a complicated construction a larger part of the generated radiation is collected by an optical conductor. In this device, radiation generated by a discharge lamp is converged by a cylindrical lens arranged beside this lamp. On the focal line of the lens a bundle of optical fibres is fanned out, which collects the converged radiation. Due to this fan of optical fibres, the quantity of collected light is enlarged, but this does not result in an increase of the brightness of the light emanating from the bundle.

The known devices have the disadvantage that the optical conductor has to be aligned with respect to the discharge lamp by the user. Furthermore, they have the disadvantage that light losses due to reflection occur not only at the surface of the light entrance window, but also at the inner and the outer surface of the lamp vessel and, with the use of a lens, at both surfaces of the lens. These losses amount to about 4% per surface.

Devices of the aforementioned kind can be used to generate radiation and to irradiate not readily accessible regions, such as cavities in the human body. For this purpose, use may also be made of lasers cooperating with an optical conductor. Lasers afford the advantage that they have a high brightness. However, they have the disadvantage they are generally operated in a pulsatory manner and that their operation requires an expensive and voluminous equipment.

The invention has for its object to provide a device of the kind mentioned in the opening paragraph, which has a very simple construction and is nevertheless capable of emitting continuously a high luminous flux via the optical conductor.

According to the invention, this object is achieved in that

-the high-pressure discharge lamp is a short arc discharge lamp and

-the optical conductor is sealed with its first end into the wall of the lamp vessel.

Short arc discharge lamps have the favourable property that electrical energy is converted therein into radiation between electrodes at a very small relative distance. The electrode gap varies from a few tenths of a millimetre for lamps of low power - (for example 0.4 mm at 50 W) to about 1 cm with very high powers (for example 9 mm at 6500 W). The discharge arc moreover is very little diffuse. Transverse to the imaginary connection line between the electrodes, the discharge arc has a very small dimension of a few tenths of a millimetre, for example 0.2 mm. As a result, the discharge arc has a very high brightness.

It is characteristic of short arc discharge lamps that the current supply conductors enter the lamp vessel at oppositely arranged areas and that the electrodes each project into the lamp vessel over a distance which is a multiple of the distance between the electrodes. The discharge space is mostly spherical or ovoidal, but may alternatively be cylindrical. The electrodes are arranged therein at least substantially concentrically. In order to ensure that the current supply conductors have a sufficiently low temperature at the area at which they emanate from the wall of the lamp vessel, this area is far remote from the relevant electrode. As a result, short arc discharge lamps have an overall length which is a few tens of times the distance between the electrodes. Nevertheless short arc discharge lamps are compact light sources which can be readily manipulated. Thus, a lamp of 50 W provided with lamp caps has, for example, a length of about 5 cm.

It is advantageous if the high-pressure discharge lamp in the irradiation device according to the invention is a direct current short arc discharge lamp. The lamp has a comparatively small electrode as cathode and a comparatively large elec-

trode as anode. The advantage of such a direct current lamp is that a large part of the generated light is emitted from a region of the discharge path which is close to the cathode and has a very high brightness.

Due to the fact that in the irradiation device according to the invention, the optical conductor is sealed with its first end into the wall of the short arc discharge lamp, the light entrance window of this optical conductor is close to the discharge arc, as a result of which a large part of the emitted radiation is incident upon the light entrance window and enters the optical conductor. If the wall portion of the discharge vessel opposite to the optical conductor is provided with a reflective coating, the quantity of the radiation thrown onto the light entrance window of the optical conductor is further enlarged.

It may be desirable when the wall portion of the discharge vessel is provided in the proximity of the optical conductor with a reflective coating to increase its temperature. For the same reason, the wall portion can be mirror-coated in the proximity of the cathode of a direct current lamp. If the device need emit radiation only via the optical conductor, the lamp vessel can be entirely or substantially entirely mirror-coated.

If desired, several optical conductors may be sealed into the wall of the discharge vessel. They may form together a bundle of optical conductors or may be arranged so as to be spread around the discharge path.

It may be recommendable if the light entrance window has a convex, for example hemispherical, surface. The quantity of radiation collected by the optical conductor can be consequently enlarged.

Besides its high efficiency, the device according to the invention has the advantage that it is very simple and compact. In contrast with known devices, the user of the device according to the invention need not align the optical conductor with respect to the radiation source because the radiation source and the optical conductor form an undetachable unit.

An optical fibre or bundle of fibres can be coupled to the optical conductor in order that the radiation can be passed to the area at which it is required. The optical fibre (bundle) may have at its exit end a convex lens, by which the emanating light is focused. The optical conductor of the device according to the invention, however, may have itself a convex surface at its end remote from the first end. Possibilities of use of the irradiation devices are inter alisthe exposure of body cavities for medical-diagnostic or therapeutical purposes, the illumination of objects which are observed through a microscope, the establishment of welding or soldering connections, the curing or drying of glue or lacquer.

The ionizable gas of the short arc discharge lamp may contain a rare gas. Moreover, mercury may be present. With additions as rare earth metal halides, indium halide, calcium halide or cadmium halide, the spectrum of the radiation emitted by the short arc discharge lamp can be adapted to specific uses of the irradiation device.

A mechanical robust construction has the irradiation device according to the invention if the optical conductor is laterally enclosed in a tube which is fused with the wall of the lamp vessel. The optical conductor may be laterally fused with this tube.

An embodiment of the device according to the invention is shown in the drawing in side elevation.

In the drawing, the device comprises a high-pressure discharge lamp 1 and an optical conductor 2. The discharge lamp 1 has a translucent lamp vessel 3 of quartz glass sealed in a vacuum-tight manner. Current supply conductors 4 extend through the wall of the lamp vessel to a pair of electrodes 5, 6 which are arranged with the lamp vessel and between which a discharge path extands. The lamp shown in the drawing is intended to be used for operation at direct voltage, the anode 5 being the cathode and the electrode 6 being the anode. The current supply conductors 4 are connected to a respective lamp cap 8. The lamp vessel 3 is filled with an ionizable gas. An optical conductor 2, which has at a first end 11 a light entrance window 12, is arranged laterally of this discharge path 7 so as to be directed with the light entrance window 12 to the discharge path 7.

The discharge lamp 1 shown in the drawing is a short arc discharge lamp, which during operation at 22 V consumes a power of 50 W. The distance between the electrodes is 0.4 mm and the ionizable filling is 10,000 Pa Xe and 11 mg Hg. During operation, the pressure of the filling increases to a few tens, e.g. 50 to 80 bar.

The optical conductor 2 is sealed with its first end 11 into the wall of the lamp vessel 3. The light entrance window 12 has a convex surface and is situated within the discharge space enclosed by the lamp vessel 3 at a distance of about 1 mm from the discharge path 7. The optical conductor 2 is laterally enclosed in and fused with a quartz glass tube 13, which is fused with the wall of the lamp vessel 3. Opposite to the light entrance window 12, the wall of the lamp vessel 3 has a reflective coating, i.e.a gold layer 9. The wall of the lamp vessel 3 further has near the cathode 5 a reflective coating 10 and near the optical conductor 2 a reflective coating to keep the lamp vessel 3 at a sufficiently high temperature during operation. The mirrors 10 and 14 are indicated in the Figure

in such a manner that the parts enveloped thereby have remained visible. The optical conductor 2 may have at its end 15 remote from the first end 11 a convex surface 16.

Another possibility to seal the optical conductor 2 into the lamp vessel 3 consists in that a bead of doped quartz is arranged at the first end 11 around the conductor and the bead is fused with the wall of the lamp vessel 3.

The optical conductor 2 has a core of SiO_2 with an envelope of SiO_2 doped with F. Instead, another optical conductor may be used, for example an optical conductor having a high refractive index at the centre line and a refractive index decreasing gradually towards the sheath, for example a conductor having a core of SiO_2 doped with germanium in a concentration decreasing towards the sheath and a sheath of SiO_2.

Claims

1. An irradiation device comprising

-a high-pressure discharge lamp provided with a translucent lamp vessel which is sealed in a vacuum-tight manner and through the wall of which current supply conductors extend to a pair of electrodes which are arranged within the lamp vessel and between which a discharge path extends, said lamp vessel being filled with an ionizable gas, and

-at least one optical conductor provided with a light entrance window at a first end, said optical conductor being arranged laterally of the discharge path in such a manner that the light entrance window is directed to the discharge path,

characterized in that

-the high-pressure discharge lamp is a short arc discharge lamp and

-the optical conductor is sealed with its first end into the wall of the lamp vessel.

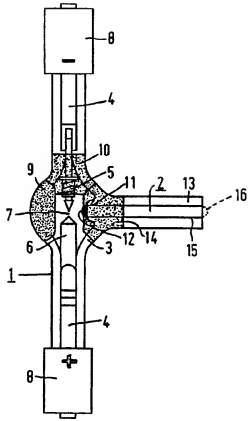
2. An irradiation device as claimed in Claim 1, characterized in that the optical conductor is laterally enclosed in a tube fused with the wall of the lamp vessel.

3. An irradiation device as claimed in Claim 2, characterized in that the optical conductor is laterally fused with the tube.

4. An irradiation device as claimed in Claim 1 or 2, characterized in that the wall of the lamp vessel is mirror-coated at least opposite to the light entrance window.

5. An irradiation device as claimed in Claim 1, 2 or 4, characterized in that the light entrance window has a convex surface.

6. An irradiation device as claimed in Claim 5, characterized in that the end of the optical conductor remote from the light entrance window has a convex surface.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European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 20 1805

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	FR-A-2 260 746 (G. NATH) * Page 3, line 32 - page 5, line 29; figure *	1	H 01 J 61/02 H 01 J 61/86
A	US-A-4 159 510 (R.J.KOVACH) * Column 2, line 32 - column 3, line 54; figures 2,3 *	1-3	
A	CH-A- 477 091 (VARIAN ASSOCIATES) * Whole document *	1,4	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 01 J 61/00
G 02 B 5/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-01-1987	SARNEEL A.P.T.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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(54) **Irradiation device.**

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FR-A- 2 290 746
US-A- 4 159 510

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EP 0 219 915 B1

Description

The invention relates to an irradiation device comprising

- a high pressure discharge lamp provided with a translucent lamp vessel, which is sealed in a vacuum-tight manner and through the wall of which current supply conductors extend to a pair of electrodes which are arranged within the lamp vessel and between which a discharge path extends, said lamp vessel being filled with an ionizable gas, and
- at least one optical conductor provided with a light entrance window at a first end, said optical conductor being arranged laterally of the discharge path in such a manner that the light entrance window is directed to the discharge path.

Such a device is known from US-A 4,009,382 .

In the known device, the optical conductor and the high-pressure discharge lamp are detachably connected to each other. Although the optical conductor has a comparatively large light entrance window, the discharge path of the discharge lamp has considerably larger dimensions so that, also due to the fact that the numerical aperture of optical conductors is small, only a small part of the generated radiation is collected by the optical conductor.

The DE-U 8,313,972 discloses a device in which due to a complicated construction a larger part of the generated radiation is collected by an optical conductor. In this device, radiation generated by a discharge lamp is converged by a cylindrical lens arranged beside this lamp. On the focal line of the lens a bundle of optical fibres is fanned out, which collects the converged radiation. Due to this fan of optical fibres, the quantity of collected light is enlarged, but this does not result in an increase of the brightness of the light emanating from the bundle.

The known devices have the disadvantage that the optical conductor has to be aligned with respect to the discharge lamp by the user. Furthermore, they have the disadvantage that light losses due to reflection occur not only at the surface of the light entrance window, but also at the inner and the outer surface of the lamp vessel and, with the use of a lens, at both surfaces of the lens. These losses amount to about 4% per surface.

Devices of the aforementioned kind can be used to generate radiation and to irradiate not readily accessible regions, such as cavities in the human body. For this purpose, use may also be made of lasers cooperating with an optical conductor. Lasers afford the advantage that they have a high brightness. However, they have the disadvantage they are generally operated in a pulsatory manner and that their operation requires an expensive and voluminous equipment.

The invention has for its object to provide a device of the kind mentioned in the opening paragraph, which has a very simple construction and is nevertheless capable of emitting continuously a high luminous flux via the optical conductor.

According to the invention, this object is achieved in that

- the high-pressure discharge lamp is a short arc discharge lamp and
- the optical conductor is sealed with its first end into the wall of the lamp vessel.

Short arc discharge lamps have the favourable property that electrical energy is converted therein into radiation between electrodes at a very small relative distance. The electrode gap varies from a few tenths of a millimetre for lamps of low power (for example 0.4 mm at 50 W) to about 1 cm with very high powers (for example 9 mm at 6500 W). The discharge arc moreover is very little diffuse. Transverse to the imaginary connection line between the electrodes, the discharge arc has a very small dimension of a few tenths of a millimetre, for example 0.2 mm. As a result, the discharge arc has a very high brightness.

It is characteristic of short arc discharge lamps that the current supply conductors enter the lamp vessel at oppositely arranged areas and that the electrodes each project into the lamp vessel over a distance which is a multiple of the distance between the electrodes. The discharge space is mostly spherical or ovoidal, but may alternatively be cylindrical. The electrodes are arranged therein at least substantially concentrically. In order to ensure that the current supply conductors have a sufficiently low temperature at the area at which they emanate from the wall of the lamp vessel, this area is far remote from the relevant electrode. As a result, short arc discharge lamps have an overall length which is a few tens of times the distance between the electrodes. Nevertheless short arc discharge lamps are compact light sources which can be readily manipulated. Thus, a lamp of 50 W provided with lamp caps has, for example, a length of about 5 cm.

It is advantageous if the high-pressure discharge lamp in the irradiation device according to the invention is a direct current short arc discharge lamp. The lamp has a comparatively small electrode as cathode and a comparatively large electrode as anode. The advantage of such a direct current lamp is that a large part of the generated light is emitted from a region of the discharge path which is close to the cathode and has a very high brightness.

Due to the fact that in the irradiation device according to the invention, the optical conductor is sealed with its first end into the wall of the short arc discharge lamp, the light entrance window of this optical conductor is close to the discharge arc, as a result of which a large part of the emitted radiation is incident upon the light entrance window and enters the optical conductor. If the wall portion of the discharge vessel opposite to the optical conductor is provided with a reflective coating, the quantity of the radiation thrown onto the light entrance window of the optical conductor is further enlarged.

It may be desirable when the wall portion of the discharge vessel is provided in the proximity of the optical conductor with a reflective coating to increase its temperature. For the same reason, the wall portion can be mirror-coated in the proximity of the cathode of a direct current lamp. If the device need emit radiation only via the optical conductor, the lamp vessel can be entirely or substantially entirely mirror-coated.

If desired, several optical conductors may be

sealed into the wall of the discharge vessel. They may form together a bundle of optical conductors or may be arranged so as to be spread around the discharge path.

It may be recommendable if the light entrance window has a convex, for example hemispherical, surface. The quantity of radiation collected by the optical conductor can be consequently enlarged.

Besides its high efficiency, the device according to the invention has the advantage that it is very simple and compact. In contrast with known devices, the user of the device according to the invention need not align the optical conductor with respect to the radiation source because the radiation source and the optical conductor form an undetachable unit.

An optical fibre or bundle of fibres can be coupled to the optical conductor in order that the radiation can be passed to the area at which it is required. The optical fibre (bundle) may have at its exit end a convex lens, by which the emanating light is focused. The optical conductor of the device according to the invention, however, may have itself a convex surface at its end remote from the first end. Possibilities of use of the irradiation devices are inter alia the exposure of body cavities for medical-diagnostic or therapeutical purposes, the illumination of objects which are observed through a microscope, the establishment of welding or soldering connections, the curing or drying of glue or lacquer.

The ionizable gas of the short arc discharge lamp may contain a rare gas. Moreover, mercury may be present. With additions as rare earth metal halides, indium halide, calcium halide or cadmium halide, the spectrum of the radiation emitted by the short arc discharge lamp can be adapted to specific uses of the irradiation device.

A mechanical robust construction has the irradiation device according to the invention if the optical conductor is laterally enclosed in a tube which is fused with the wall of the lamp vessel. The optical conductor may be laterally fused with this tube.

An embodiment of the device according to the invention is shown in the drawing in side elevation.

In the drawing, the device comprises a high-pressure discharge lamp 1 and an optical conductor 2. The discharge lamp 1 has a translucent lamp vessel 3 of quartz glass sealed in a vacuum-tight manner. Current supply conductors 4 extend through the wall of the lamp vessel to a pair of electrodes 5, 6 which are arranged with the lamp vessel and between which a discharge path extends. The lamp shown in the drawing is intended to be used for operation at direct voltage, the anode 5 being the cathode and the electrode 6 being the anode. The current supply conductors 4 are connected to a respective lamp cap 8. The lamp vessel 3 is filled with an ionizable gas. An optical conductor 2, which has at a first end 11 a light entrance window 12, is arranged laterally of this discharge path 7 so as to be directed with the light entrance window 12 to the discharge path 7.

The discharge lamp 1 shown in the drawing is a short arc discharge lamp, which during operation at 22 V consumes a power of 50 W. The distance between the electrodes is 0.4 mm and the ionizable filling is 10,000 Pa Xe and 11 mg Hg. During operation, the pressure of the filling increases to a few tens, e.g. 50 to 60 bar.

The optical conductor 2 is sealed with its first end 11 into the wall of the lamp vessel 3. The light entrance window 12 has a convex surface and is situated within the discharge space enclosed by the lamp vessel 3 at a distance of about 1 mm from the discharge path 7. The optical conductor 2 is laterally enclosed in and fused with a quartz glass tube 13, which is fused with the wall of the lamp vessel 3. Opposite to the light entrance window 12, the wall of the lamp vessel 3 has a reflective coating, i.e.a gold layer 9. The wall of the lamp vessel 3 further has near the cathode 5 a reflective coating 10 and near the optical conductor 2 a reflective coating 14 to keep the lamp vessel 3 at a sufficiently high temperature during operation. The mirrors 10 and 14 are indicated in the Figure in such a manner that the parts enveloped thereby have remained visible. The optical conductor 2 may have at its end 15 remote from the first end 11 a convex surface 16.

Another possibility to seal the optical conductor 2 into the lamp vessel 3 consists in that a bead of doped quartz is arranged at the first end 11 around the conductor and the bead is fused with the wall of the lamp vessel 3.

The optical conductor 2 has a core of SiO_2 with an envelope of SiO_2 doped with F. Instead, another optical conductor may be used, for example an optical conductor having a high refractive index at the centre line and a refractive index decreasing gradually towards the sheath, for example a conductor having a core of SiO_2 doped with germanium in a concentration decreasing towards the sheath and a sheath of SiO_2.

Claims

1. An irradiation device compdising
- a high-pressure discharge lamp provided with a translucent lamp vessel which is sealed in a vacuum-tight manner and through the wall of which current supply conductors extend to a pair of electrodes which are arranged within the lamp vessel and between which a discharge path extends, said lamp vessel being filled with an ionizable gas, and
- at least one optical conductor provided with a light entrance window at a first end, said optical conductor being arranged laterally of the discharge path in such a manner that the light entrance window is directed to the discharge path,

characterized in that
- the high-pressure discharge lamp is a short arc discharge lamp and
- the optical conductor is sealed with its first end into the wall of the lamp vessel.

2. An irradiation device as claimed in Claim 1, characterized in that the optical conductor is laterally enclosed in a tube fused with the wall of the lamp vessel.

3. An irradiation device as claimed in Claim 2, characterized in that the optical conductor is laterally fused with the tube.

4. An irradiation device as claimed in Claim 1 or 2, characterized in that the wall of the lamp vessel is mirror-coated at least opposite to the light entrance window.

5. An irradiation device as claimed in Claim 1, 2 or 4, characterized in that the light entrance window has a convex surface.

6. An irradiation device as claimed in Claim 5, characterized in that the end of the optical conductor remote from the light entrance window has a convex surface.

Patentansprüche

1. Bestrahlungseinrichtung, die
– eine Hochdruckentladungslampe mit einem lichtdurchlässigen Lampenkolben, der vakuumdicht abgeschlossen ist und durch dessen Wand sich Stromzuführungsleiter zu einem Elektrodenpaar erstrecken, die im Lampenkolben angeordnet sind und zwischen denen sich eine Entladungsstrecke befindet, wobei der Lampenkolben mit einem ionisierbaren Gas gefüllt ist, und
– wenigstens einen optischen Leiter mit einem Lichteintrittsfenster an einem ersten Ende enthält, der lateral zur Entladungsstrecke derart angeordnet ist, daß das Lichteintrittsfenster auf die Entladungsstrecke ausgerichtet ist, dadurch gekennzeichnet, daß
– die Hochdruckentladungslampe eine Kurzbogenentladungslampe ist und
– der optische Leiter mit seinem ersten Ende in der Wand des Lampenkolbens verschmolzen ist.

2. Bestrahlungseinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der optische Leiter lateral in ein Rohr aufgenommen ist, die mit der Wand des Lampenkolbens verschmolzen ist.

3. Bestrahlungseinrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der optische Leiter lateral mit dem Rohr verschmolzen ist.

4. Bestrahlungseinrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Wand des Lampenkolbens wenigstens gegenüber dem Lichteintrittsfenster verspiegelt ist.

5. Bestrahlungseinrichtung nach Anspruch 1, 2 oder 4, dadurch gekennzeichnet, daß das Lichteintrittsfenster eine konvexe Oberfläche hat.

6. Bestrahlungseinrichtung nach Anspruch 5, dadurch gekennzeichnet, daß das vom Lichteintrittsfenster abgewandte Ende des optischen Leiters eine konvexe Oberfläche hat.

Revendications

1. Dispositif d'irradiation comprenant
– une lampe à décharge à haute pression munie d'une ampoule de lampe translucide, qui est scellée d'une façon étanche au vide et à travers la paroi de laquelle des entrées de courant s'étendent vers une paire d'électrodes qui sont disposées dans l'ampoule de lampe et entre lesquelles s'étend un trajet à décharge, ladite ampoule de lampe étant remplie d'un gaz ionisable et
– au moins un conducteur optique muni d'une fenêtre d'entrée de lumière à une extrémité, ledit conducteur optique étant disposé latéralement par rapport au trajet à décharge de façon que la fenêtre d'entrée de lumière soit dirigée vers le trajet à décharge, caractérisé en ce que
– la lampe de décharge à haute pression est une lampe à décharge à arc court et
– la conducteur optique est scellé par sa première extrémité dans la paroi de l'ampoule de la lampe.

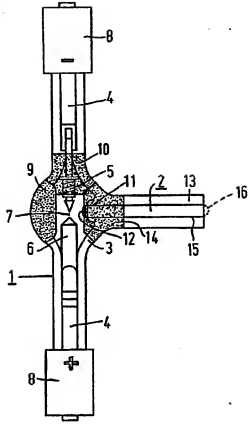
2. Dispositif d'irradiation selon la revendication 1, caractérisé en ce que le conducteur optique est enfermé latéralement dans un tube scellé à la paroi de l'ampoule de lampe.

3. Dispositif d'irradiation selon la revendication 2, caractérisé en ce que le conducteur optique est latéralement scellé au tube.

4. Dispositif d'irradiation selon la revendication 1 ou 2, caractérisé en ce que la paroi de l'enceinte à décharge est revêtue d'une façon réflectrice au moins vis-à-vis de la fenêtre d'entrée de lumière.

5. Dispositif d'irradiation selon la revendication 1, 2 ou 4, caractérisé en ce que la fenêtre d'entrée de lumière présente une surface convexe.

6. Dispositif d'irradiation selon la revendication 5, caractérisé en ce que l'extrémité du conducteur optique située vis-à-vis de la fenêtre d'entrée de lumière présente une surface convexe.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⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　昭62－98554

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⑤4発明の名称　照射装置

②1特　願　昭61－248523

②2出　願　昭61(1986)10月21日

優先権主張　③1985年10月21日③3オランダ(NL)③8502862

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最終頁に続く

明　細　書

1.発明の名称　照射装置

2.特許請求の範囲

1.　イオン化ガスが充填され且つ真空密に封着された半透明なランプ容器を設け、該ランプ容器の壁を貫通して電流供給導体が、ランプ容器内に配置された一対の電極まで延在し、該電極の間に放電通路が延在する高圧放電灯と、

第1端部に光入射窓が設けられ、該光入射窓が放電通路に向けられるように放電通路に対し横方向に配置された少なくとも1個の光伝導体とを具える照射装置において、

前記高圧放電灯をショートアーク放電灯とし、

前記光伝導体をその第1端部でランプ容器の壁に封入するようにしたことを特徴とする照射装置。

2.　前記光伝導体がランプ容器の壁に融合された管に横向きに取り囲まれるようにしたことを特徴とする特許請求の範囲第1項記載の照射装置。

3.　前記光伝導体を前記管に融合するようにしたことを特徴とする特許請求の範囲第2項記載の照射装置。

4.　前記ランプ容器の、少なくとも光入射窓と向かい合う壁をミラーコーティングするようにしたことを特徴とする特許請求の範囲第1項または第2項記載の照射装置。

5.　前記光入射窓を凸面としたことを特徴とする特許請求の範囲第1項，第2項または第4項記載の照射装置。

6.　前記光伝導体の、光入射窓と隣間する端部を凸面とするようにしたことを特徴とする特許請求の範囲第5項記載の照射装置。

3.発明の詳細な説明

本発明はイオン化ガスが充填され且つ真空密に封着された半透明なランプ容器を設け、該ランプ容器の壁を貫通して電流供給導体が、ランプ容器内に配置された一対の電極まで延在し、該電極の

間に放電通路が延在する高圧放電灯と、第1端部に光入射窓が設けられ、該入射窓が放電通路に向けられるように放電通路に対し横方向に配置された少なくとも1個の光伝導体とを具える照射装置に関するものである。

斯る装置は、1977年2月22日にギュンター・ナスにより出願された米国特許第4,009,382号明細書から既知である。

この既知の装置において、光伝導体および高圧放電灯は相互に着脱自在に接続されている。しかし、この光伝導体は光入射窓が比較的大きいため、放電灯の放電通路の寸法が比較的大きくなり、また、光伝導体の開口数が小さいことから、発生された放射線のほんの一部分だけが、光伝導体により捕捉される。

また、1983年11月3日にヘルムート・フントによって出願された独国実用新案第8,313,972号公報には、複雑な構造のため、発生された放射線の大部分が光伝導体により捕捉される装置が開示されている。この装置において、放電灯により発生された放射線は、この放電灯のわきに配設された円筒状レンズにより集束される。このレンズの焦線上に光ファイバの束を扇状に広げて、この光ファイバで集束された放射線を捕捉する。この扇状の光ファイバのため、捕捉された光の量が大きくなるが、光ファイバの束から放出する光の明るさが増大することにはならない。

これら既知の装置は、ユーザーによって放電灯の位置合せをする必要がある。さらに、反射のため光損失が、光入射窓の表面のみならず、ランプ容器の内表面および外表面で、およびレンズを用いる場合にはレンズの両面でも生ずるという欠点を有している。これら光損失の量は一表面当り約4%である。

上述した種類の装置は、放射線を発生すること、および体腔のような直ぐに走査できない領域を照射するのに使用することができる。この目的のため、光伝導体と共働するレーザを利用し得るようにする。レーザは放出光を明るくするという利点をもたらす。しかし、レーザは一般に、パルス状に動作させるという欠点があり、この動作は高価となり、大型の装置を必要とする。

本発明の目的は、極めて簡単な構造であるにもかかわらず、光伝導体を経て高い光度の光束を連続的に放出することができる照射装置を提供せんとするにある。

本発明は、イオン化ガスが充填され且つ真空密に封着された半透明なランプ容器を設け、該ランプ容器の壁を貫通して電流供給導体が、ランプ容器内に配置された一対の電極まで延在し、該電極の間に放電通路が延在する高圧放電灯と、第1端部に光入射窓が設けられ、該光入射窓が放電通路に向けられるように放電通路に対し横方向に配置された少なくとも1個の光伝導体とを具える照射装置において、前記高圧放電灯をショートアーク放電灯とし、前記光伝導体をその第1端部でランプ容器の壁に封入するようにしたことを特徴とする。

ショートアーク放電灯は、その内部の極めて短い相対距離に配置された電極間で電気的エネルギー放射線に変換するという良好な特徴を有している。電極間隔は、低電力の放電灯に対しての10分の数ミリメータ（例えば50Wについて0.4mm）から極めて高い電力における約1cm（例えば6500Wでは9mm）まで変化する。さらに、放電アークはほとんど発散されない。電極間の仮想接続線と直交する方向に、放電アークは10分の数ミリメータ程度（例えば0.2mm）の極めて小さな寸法を有している。この結果、放電アークは極めて明るくなる。

このショートアーク放電灯は、電流供給導体が反射鏡に配置された区域でランプ容器に入り込んでおり、電極は電極間の距離の倍数だけランプ容器内に大々突出しているという特徴を有している。放電スペースはほとんどが球形かまたは卵形であるが、円筒形とすることもできる。この電極は、少なくともほぼ同心状に配置されている。電流供給導体は、これらがランプ容器の壁から出る区域で十分に低い温度となるようにするために、この区域を関連する電極からかなり離している。この結

果として、ショートアーク放電灯は、電極間の距離の10分の数倍の全長を有する。それでもやはりショートアーク放電灯は、極作の容易な小型の光源である。したがって、ランプ口金が設けられた50Wのランプは、例えば、約5cm　の長さを有する。

本発明の照射装置の高圧放電灯が直流電流型のショートアーク放電灯である場合に有利である。この放電灯は、陰極として比較的小さな電極を有し、陽極として比較的大きな電極を有する。かかる直流電流型放電灯の利点は、発生された光の大部分が陰極に近い放電通路の領域から放出され、放出された光が極めて明るいことである。

本発明による照射装置において、光伝導体はその第1端部で、ショートアーク放電灯の壁に封入され、この光伝導体の光入射窓が放電アークに近接されているため、放出された放射線の大部分が光入射窓に入射し、光伝導体に入る。光伝導体と対向する放電灯の容器の壁部分に反射被膜が設けられている場合に、光伝導体の光入射窓に投射される放射線の量は、さらに大きくなる。

放電灯の容器の壁部分に、光伝導体に近接して、反射被膜が設けられて、その温度が上昇するのが望ましい。同じ理由から、壁部分の、直流電流型放電灯の陰極に近い部分にミラーコーティングを設けることができる。この装置が光伝導体を経て放射線のみを放出する必要がある場合に、ランプ容器を、全体に、またははば全体にミラーコーティングすることができる。

所望により、数個の光伝導体をランプ容器の壁に封入してもよい。これら光伝導体は、光伝導体の束を形成するか、または放電通路の回りに広がるように配置することができる。

光入射窓が、例えば半球状の凸面である場合が勧められる。したがって、光伝導体により集められた放射線の量が多くなる。

本発明の装置は、高効率のわりに、極めて簡単で且つ小型である。既知の装置と比較して、本発明の装置のユーザは、放射線源に関して光伝導体を移動する必要がない。この理由は、放射線源および光伝導体は脱着できないユニットを形成するからである。

光ファイバまたは光ファイバの束を、光伝導体に結合して、放射線を所望の区域に導すことができる。光ファイバ（束）はその射出面に凸レンズを備え、これにより放出光が集束される。しかし、本発明の装置の光伝導体は、第1端部と隣接する端部それ自体に凸表面を設けることもできる。

照射装置は、特に、医学的診断若しくは治療目的のため、体腔をさらすこと、顕微鏡を通して観察される物体の照射、溶接またははんだ付の硬立、接着剤またはラッカーの硬化または乾燥等の用途がある。

ショートアーク放電灯のイオン化ガスはレアガスを含有させることができる。さらに水銀を含有させることができる。希土類ハロゲン化物として、インジウムハロゲン化物，カルシウムハロゲン化物，またはカドミウムハロゲン化物を添加して、ショートアーク放電灯により放出された放射線のスペクトルを、照射装置の用途に適合させることができる。

光伝導体が、ランプ容器の壁に溶け合わされた管に横向きに囲まれる場合に、本発明の照射装置は機械的に強い構体となる。光伝導体はこの管に横向きに溶け合わされる。

図面につき本発明の実施例を説明する。

図において、照射装置は高圧放電灯1および光伝導体2を具える。高圧放電灯1は真空密に封着された石英ガラスより成る半透明のランプ容器3を有する。電流供給導体4は、ランプ容器の壁を通り一対の電極5，6に延在し、この一対の電極5，6はランプ容器に配設され、これら電極5，6の間に放電通路が延在する。図に示した高圧放電灯は直流電圧で動作するようにしており、そのため電極5を陰極とし、電極6を陽極とする。電流供給導体4を口金8に夫々接続する。ランプ容器3はイオン化ガスで満たされている。第1端部11に光入射窓12を有する光伝導体2を前記放電通路7の軸方向に配設して、光入射窓12が放電通路7に向くようにする。

図示した放電灯は、ショートアーク放電灯であり、22Vで動作中に50Wの電力を消費する。電極間の距離は0.4 mmであり、充填されるイオン化ガスは、10,000 パスカルのキセノンガスおよび11 mgの水銀である。動作中には、この充填ガスの圧力は数十バール、例えば50乃至60バール(bar)まで増加する。

光伝導体2をその端部11でランプ容器3の壁に封入する。光入射窓12は、凸面を有し、ランプ容器3により囲まれる放電空間内に放電通路7から約1 mmの距離に配置される。光伝導体2は石英ガラス管13に取り囲まれ、石英ガラス管13に融合され、ランプ容器3の壁に融合される。ランプ容器3の壁は光入射窓12に対向する位置に反射被膜、例えば金よりなる層9を有する。さらに、ランプ容器3の壁は、陰極5の近くに反射被膜10を有し、および光伝導体の近くに反射被膜14を有して、動作中にランプ容器3を十分な高温に保持する。これら反射被膜即ちミラー10および14は、これらに含まれる部分を可視化させて、図面にて現されている。光伝導体2は第1端部11から離間するその端部15に凸面16を設けることができる。

光伝導体2をランプ容器3に封入する他の可能性としては、ビーズをドープした石英を光伝導体の回りの第1端部11に配設し、ランプ容器3の壁にビーズを溶かし込むことが考えられる。

光伝導体2には7ッ素がドープされた二酸化珪素よりなるエンベロープに二酸化珪素よりなるコアを設ける。また、代わりに、例えば中心部で屈折率が高く、外被に向かって徐々に屈折率が減少する光伝導体、およびゲルマニウムがドープされた二酸化珪素のコアを有し、このコアから二酸化珪素のみよりなる外被に向ってゲルマニウムのドープ濃度を減少させた光伝導体を使用することができる。

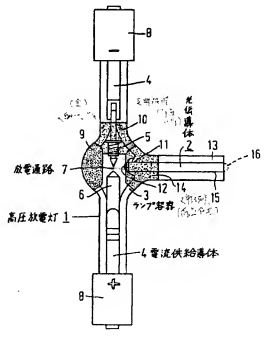
4.図面の簡単な説明

第1図は、本発明の放射線装置の側面図である。

1…高圧放電灯　2…光伝導体
3…ランプ容器　4…電流供給導体
5，6…電極　7…放電通路
8…口金　9，10，14…反射被膜
12…光入射窓　13…石英ガラス管
16…凸面

第1図

1/1



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代理人弁理士　杉村暁秀
同弁理士　杉村興作

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【図1】

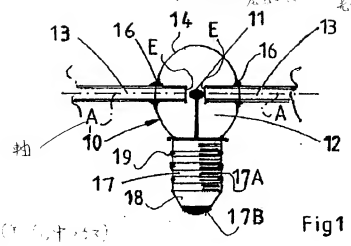

Fig1

【図2】

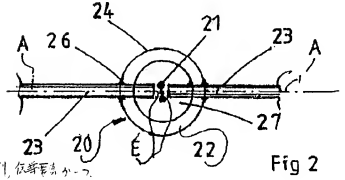

Fig 2

【図3】

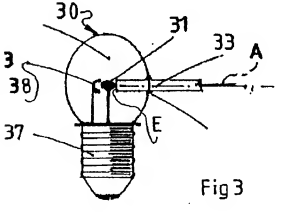

Fig 3

【図4】

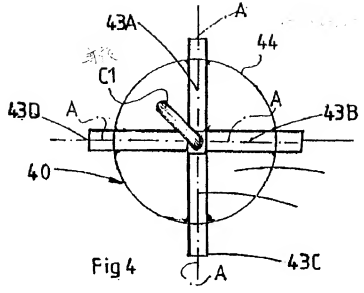

Fig 4

【図5】

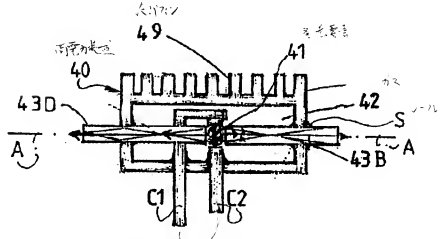

Fig 5

【図6】

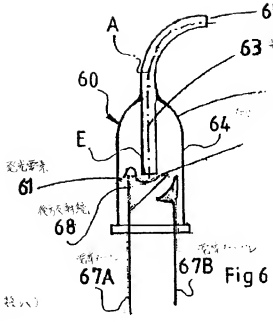

Fig 6

【図7】

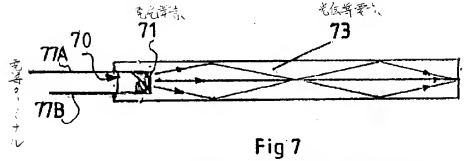

Fig 7

【図８】

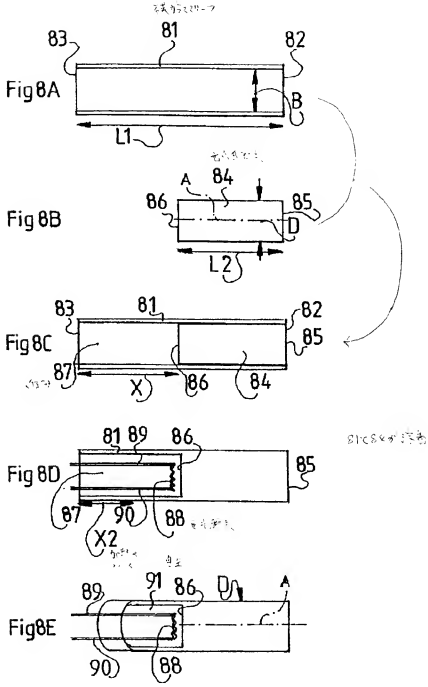
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Fig8E

【図９】

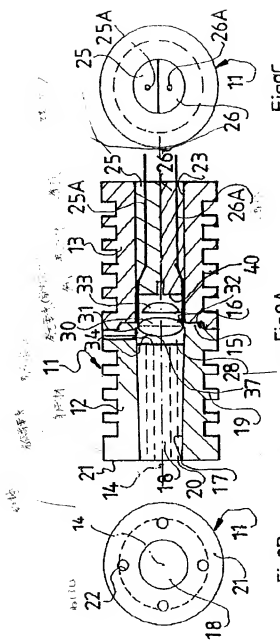

Fig9B　Fig9A　Fig9C

【図１０】

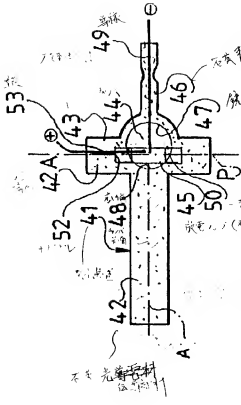

Fig10